

CLAIMS

1 1. A method of monitoring a treatment site, comprising:

2 providing an apparatus for monitoring a temperature change at a tissue site, the apparatus
3 including a scattered light measurement device that produces an excitation beam and an output
4 device;

5 producing an excitation beam to scatter from the tissue site;

6 monitoring temperature or temperature changes of the tissue site; and

7 providing to an observer an indicative of the temperature change at the tissue site.

1 2. A method of monitoring a treatment site, comprising:

2 providing an apparatus for monitoring a temperature induced change at a tissue site, the
3 apparatus including a scattered light measurement device that produces an excitation beam and
4 an output device;

5 producing an excitation beam to scatter from the tissue site;

6 monitoring the temperature induced changes of the tissue site; and

7 providing to an observer an indicative of the temperature induced change at the tissue
8 site.

1 3. An apparatus for monitoring a temperature change at a tissue site that is observed

2 by an observer, comprising:

3 a scattered light measurement device that produces an excitation beam to scatter from the

4 tissue site and monitor temperature or temperature changes of the tissue site; and

5 an output device that provides an output to the observer that is indicative of the

6 temperature change at the tissue site.

1 4. The apparatus of claim 3, wherein the output is at least one of an output through a

2 computer, an output through a heads up display, through a slit lamp, an audible output or a print

3 out of information.

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1 5. An apparatus for monitoring temperature induced changes at a tissue site,
2 comprising:
3 a scattered light measurement device that produces an excitation beam to scatter from the
4 tissue site and monitor temperature induced changes of the tissue site; and
5 an output device that provides an output to an observer that is indicative of the
6 temperature induced change at the tissue site.

1 6. The apparatus of claim 5, wherein the output is at least one of an output through a
2 computer, an output through a heads up display, through a slit lamp, an audible output or a print
3 out of information.

1 7. A treatment apparatus for a tissue site, comprising:
2 an energy device that produces energy delivered to the tissue site;
3 a scattered light measurement device that delivers an excitation beam to scatter off the
4 tissue site and monitor temperature, temperature changes or temperature induced changes of the
5 tissue site; and
6 an output device that provides an output to an operator, which is indicative of the
7 measured changes at the tissue site, such that the operator can control the treatment.

8 8. A treatment apparatus for a tissue site, comprising:
9 an energy device that produces energy delivered to the tissue site;
10 a scattered light measurement device that delivers an excitation beam to scatter off the
11 treatment site and monitors temperature, temperature changes or temperature induced changes of
12 the tissue site; and
13 a control device coupled to the energy device and the scattered light measurement device,
14 which, in response to the changes, controls the output energy of the treatment beam to the tissue
15 site.

1 9. The apparatus of claim 8, wherein the scattered light correlates to a birefringence
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 10. The apparatus of claim 8, wherein the scattered light correlates to a chemical
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 11. The apparatus of claim 8, wherein the scattered light correlates to a thermal effect
2 resulting from the delivery of the treatment beam to the tissue site.

1 12. The apparatus of claim 8, wherein the scattered light correlates to a mechanical
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 13. The apparatus of claim 8, wherein the scattered light correlates to a polarization
2 change resulting from the delivery of the treatment beam to the tissue site.

1 14. The apparatus of claim 8, wherein the treatment site is skin.

1 15. The apparatus of claim 8, wherein the treatment site is the cornea of an eye.

1 16. The apparatus of claim 8, wherein the treatment site is a tumor.

1 17. The apparatus of claim 8, wherein the treatment site is a vascular structure.

1 18. A treatment apparatus for an eye, comprising:
2 an energy device that produces a treatment beam delivered to a tissue site;
3 a scattered light measurement device that delivers an excitation beam to scatter off the
4 treatment eye ; and
5 a control device coupled to the energy device and the scattered light measurement device,
6 in response to a change in the scattered light from the excitation beam, the control device
7 controlling the output energy of the treatment beam while the scattered light measurement device
8 monitors the change in scattered light.

1 19. The apparatus of claim 18, wherein the scattered light correlates to a birefringence
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 20. The apparatus of claim 18, wherein the scattered light correlates to a chemical
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 21. The apparatus of claim 18, wherein the scattered light correlates to a thermal
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 22. The apparatus of claim 18, wherein the scattered light correlates to a mechanical
2 effect resulting from the delivery of the treatment beam to the tissue site.

1 23. The apparatus of claim 18, wherein the scattered light correlates to a polarization
2 change resulting from the delivery of the treatment beam to the tissue site.

1 24. The apparatus of claim 18, wherein the treatment delivers the treatment beam to
2 the tissue site until a threshold is reached.

1 25. The apparatus of claim 18, wherein the excitation beam of the scattered light
2 measurement device is selected from a laser or an illumination source.

1 26. The apparatus of claim 18, wherein the scattered light measurement device is
2 selected from a polarization device, a phase sensitive optical device, and a birefringent device.

1 27. The apparatus of claim 26, wherein the phase sensitive optical device is a phase
2 sensitive optical coherence tomographer (PS-OCT).

1 28. The apparatus of claim 26, wherein the polarization device is a scanning laser
2 ophthalmoscope.

1 29. The apparatus of claim 26, wherein the polarization device can vary polarization
2 from 0 to 360 degrees.

1 30. The apparatus of claim 29, wherein the variation in polarization is of the source,
2 the detector, or both.

1 31. The apparatus of claim 26, wherein the PS-OCT observes phase sensitive changes
2 or changes in polarization at specific depths within the tissue site.

1 32. The apparatus of claim 26, wherein the polarization device monitors changes at
2 variable and specific depths in the tissue site.

1 33. The apparatus of claim 26, wherein the polarization device monitors full thickness
2 changes in the tissue site.

1 34. The apparatus of claim 18, wherein the scattered light measurement device
2 provides measurements at the treatment site and at an off treatment site.

1 35. The apparatus of claim 18, wherein the scattered light measurement device
2 provides measurement by comparing a current measurement to a baseline measurement at the
3 treatment site.

1 36. The apparatus of claim 18, wherein the scattered light measurement device
2 determines a change at the treatment site by comparing the off treatment site with the treatment
3 site.

1 37. The apparatus of claim 18, wherein the measurements produce a map of the
2 monitored area.

1 38. The apparatus of claim 18, wherein the scattered light measurement device
2 measures absolute temperature.

1 39. The apparatus of claim 18, wherein the treatment beam has a wavelength that has
2 sufficient transmission efficiency to pass through the cornea, lens and aqueous.

1 40. The apparatus of claim 18, wherein the treatment beam has a wavelength that is a
2 visible or IR wavelength.

1 41. The apparatus of claim 18, wherein control device tracks a time related treatment
2 history from information obtained from the scattered light measurement device.

1 42. The apparatus of claim 41, wherein the time related treatment history includes
2 information selected from a history of all previous results, rate of change of scattered light
3 intensities as a result of temperature or tissue changes, and algorithms to extrapolate future
4 treatment based upon present and past data records.

1 43. The apparatus of claim 18, wherein the control device provides a signal to the
2 energy delivery device to adjust a parameter of the energy device selected from power, interval,
3 duration, intensity and duty cycle.

1 44. The apparatus of claim 18, wherein the parameter of the energy device is adjusted
2 to create a desired treatment effect selected from rise time, duration at a given temperature effect,
3 desired fluctuations over time and desired changes in treatment effects.

1 45. The apparatus of claim 18, wherein energy device and the scattered light
2 measurement device are the same device.

1 46. The apparatus of claim 45, wherein the treatment beam is used as the excitation
2 beam.

1 47. The apparatus of claim 18, further comprising:
2 a delivery device coupled to the light energy device.

1 48. The apparatus of claim 18, wherein the delivery device images the treatment
2 beam from the light energy device into a known spot size on the retina.

1 49. The apparatus of claim 18, wherein the delivery device directs the excitation
2 beam into a beam path of the treatment beam.

1 50. The apparatus of claim 18, further comprising:
2 a viewing device for viewing on axis.

- 1 51. The apparatus of claim 50, wherein the viewing device is a slit lamp.
- 1 52. The apparatus of claim 50, wherein the excitation beam is delivered off axis.
- 1 53. The apparatus of claim 18, further comprising:
2 an optical member that is highly reflective at the excitation wavelength.
- 1 54. The apparatus of claim 18, further comprising:
2 an optical device that provides a user with an unobstructed view of the eye illuminated by
3 white light while missing a section of wavelengths at the treatment wavelength and at the
4 excitation wavelength.
- 1 55. The apparatus of claim 19, wherein the tissue site is the optic nerve head.
- 1 56. The apparatus of claim 19, wherein the tissue site is Henle's layer.